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Inertial collapse and oscillations of a bubble in a compressible viscoelastic medium ERIC JOHNSEN, University of Michigan, Ann Arbor, CHENGYUN HUA, California Institute of Technology — The inertial collapse and subsequent oscillations of a bubble in a compressible viscoelastic medium are studied theoretically and numerically in the context of therapeutic ultrasound. The focus of the present work is on the response of a bubble subjected to a step increase in pressure, i.e., Rayleigh collapse. Linear constitutive relations that include stress relaxation, elasticity, viscosity and strain rate relaxation are considered. A perturbation analysis is followed to estimate the damping, frequency and relaxation of the oscillations. The results are compared to numerical solutions of the Keller equation, showing good agreement over a wide range of parameters. The nonlinear coupling between viscosity, compressibility, elasticity and relaxation leads to unexpected bubble behavior, e.g., sustained oscillations when damping is expected. Direct simulations of the full three-dimensional equations of motion will be discussed, including viscous and viscoelastic effects, non-spherical behavior and nonlinear constitutive models.

Eric Johnsen
University of Michigan, Ann Arbor

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